THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Florence A. Hill; a Common Rhea (*Rhea americana*) from Uruguay, presented by Mr. F. R. S. Balfour; a Common Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. A. Lidbury; a Wood Owl (*Syrnium aluco*), British, presented by Mrs. W. Duncan; two Horned Lizards (*Phrynosoma cornutum*) from Texas, presented by Mr. John G. Witte; two Marbled Newts (*Triton marmorata*) from France, presented by Mr. G. H. King; two Viverrine Cats (*Felis viverrina*), an Indian Otter (*Lutra nair*), an Indian Darter (*Plotus melanogaster*), a Hamilton's Terrapin (*Clemmys hamiltoni*), three Indian Gazelles (*Gazella bennetti*) from India, deposited; two Natterjack Toads (*Bufo calamita*), four Marbled Newts (*Triton marmorata*), four Short-nosed Sea Horses (*Hippocampus antiquorum*), from France, purchased; a Black Wolf (*Canis niger*) from India, received in exchange; an Eland (*Oreas canna* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN

D'ARREST'S COMET.—Although M. Leveau's elements of this comet for the approaching return to perihelion were communicated to the Academy of Sciences of Paris on January 22, they were unaccompanied by predicted places, and it would appear that the ephemeris has had only a very limited circulation, being confined, if we are rightly informed, to those observers who are in possession of the larger instruments. Hence comparatively few persons may have become acquainted with the circumstances under which this return of the comet to perihelion takes place, and it may not be without interest if we briefly examine the conditions as compared with those of former appearances.

Assuming as usual the intensity of the comet's light (I) to be represented by the reciprocal of the product of the squares of the distances from the earth and sun, we find the following values:—

		I.
1851.	Last observation at Berlin, Oct. 6	0·590
1858.	Last observation at the Cape, Jan. 18 ...	0·151
1870.	Last observation at Athens, Dec. 20 ...	0.154
1877.	Last observation at Athens, Sept. 10 ...	0·127

The greatest distance from the earth at any of these dates was 1·93 on January 18, 1858.

M. Leveau's elements for the approaching return apply to 1883, June 12·0 M.T. at Paris; neglecting, of course, the small effect of perturbation in the interval, the perihelion passage is found to take place 1884, January 13·5765 M.T. at Greenwich. The coordinate constants for apparent equinox of 1883, May 1, are:—

$$x = r\,.\,[9{\cdot}99502]\sin(v + 50^{\circ}\;13'{\cdot}7).$$
$$y = r\,.\,[9{\cdot}99308]\sin(v + 321\;48{\cdot}0).$$
$$z = r\,.\,[9{\cdot}36631]\sin(v + 280\;38{\cdot}1).$$

Hence we have the following approximate positions and distances of the comet, with the corresponding values of the theoretical intensity of light, taking dates near the time of new moon:—

12h. G.M.T.	R.A. h. m.	Decl. ° ′	Distance from Earth.	Distance from Sun.	I.
June 6 ...	13 9·6 ...	+12 48 ...	2·037 ...	2·615 ...	0·035
July 4 ...	13 13·7 ...	+10 12 ...	2·185 ...	2·415 ...	0·036
Aug. 2 ...	13 37·0 ...	+ 5 42 ...	2·321 ...	2·204 ...	0·038
Nov. 29 ...	17 58·6 ...	−16 55 ...	2·281 ...	1·427 ...	0·094
Dec. 29 ...	19 45·7 ...	−18 8 ...	2·244 ...	1·338 ...	0·111

Whence it will be seen that even when most favourably circumstanced, towards the end of the year, the intensity of light will be less than the lowest value at which the comet has hitherto been observed, viz. 0·127. On November 29 the comet sets about 2h. 8m. after the sun. It was missed at the return in 1864, and the chances of observation at its present visit are by no means encouraging.

Mr. Common informs us that he has made a thorough search for the comet with his large reflector, but without success up to May 7. He remarks that the number of faint nebulæ about its track is surprising.

The orbit of this comet almost intersects that of the lost comet of De Vico, 1844; in heliocentric longitude 339°·37′, with the elements of 1851, the distance between the orbits was only 0·0055 or 507,000 miles.

TEMPEL'S COMET, 1873 II.—The corrected elements of this body by M. Schulhof, from observations at its last appearance in 1878, indicate that, neglecting perturbations, it may be again in perihelion about November 20. The positions calculated on this assumption show that the comet will be very unfavourably placed for observation, and it may escape detection at this return.

RULES AND REGULATIONS FOR THE PREVENTION OF FIRE RISKS ARISING FROM ELECTRIC LIGHTING[1]

THESE rules and regulations are drawn up for the reduction to a minimum, in the case of electric lighting, of those risks of fire which are inherent in every system of artificial illumination, and also for the guidance and instruction of those who have, or who contemplate having, electric lighting apparatus installed on their premises.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing," or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the dangerous production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are either ordinarily or for the purpose of testing, passed through the circuit. Should wires become perceptibly warmed by the ordinary current, it is an indication that they are too small for the work they have to do, and that they should be replaced by larger wires. Bare or exposed conductors should always be within visual inspection and as far out of reach as possible, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon such conductors, would lead to "short circuiting," and the consequent sudden generation of heat due to an increased current in conductors not adapted to carry it with safety.

The necessity cannot be too strongly urged for guarding against the presence of moisture and the use of "earth" as part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and danger.

The chief dangers of every new application of electricity arise from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

The greatest element of safety is therefore the employment of skilled and experienced electricians to supervise the work.

I. THE DYNAMO MACHINE

1. The dynamo machine should be fixed in a dry place.
2. It should not be exposed to dust or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be practically perfect.
5. All conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II. THE WIRES

6. Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left it cannot permit of a permanent arc or of heating.
7. Every part of the circuit should be so determined, that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and all junctions with a smaller conductor should be fitted with a suitable safety fuse or protector, so that

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[1] Recommended by the Council of the Society of Telegraph Engineers and of Electricians in accordance with the Report of the Committee appointed by them on May 11, 1882, to consider the subject. Members of the Committee:—Prof. W. G. Adams, F.R.S., Sir Charles T. Bright, T. Russell Crampton, R. E. Crompton, W. Crookes, F.R.S., Warren De La Rue, D.C.L., F.R.S., Prof. G. C. Foster, F.R.S., Edward Graves, J. E. H. Gordon, Dr. J. Hopkinson, F.R.S., Prof. D. E. Hughes, F.R.S., W. H. Preece, F.R.S., Alexander Siemens, C. E. Spagnoletti, James N. Shoolbred, Augustus Stroh, Sir William Thomson, F.R.S., Lieut.-Col. C. E. Webber, R.E.

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no portion of the conductor should ever be allowed to attain a temperature exceeding 150° F.

8. Under ordinary circumstances complete metallic circuits should be used; the employment of gas or water pipes as conductors for the purpose of completing the circuit should not in any case be allowed.

9. Bare wires passing over the tops of houses should never be less than seven feet clear of any part of the roof, and all wires crossing thoroughfares should invariably be high enough to allow fire-escapes to pass under them.

10. It is most essential that joints should be electrically and mechanically perfect and united by solder.

11. The position of wires when underground should be clearly indicated, and they should be laid down so as to be easily inspected and repaired.

12. All wires used for indoor purposes should be efficiently insulated, either by being covered throughout with some insulating medium, or, if bare, by resting on insulated supports.

13. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses, like iron girders or pipes, they should be thoroughly protected by suitable additional covering; and where they are liable to abrasion from any cause, or to the depredations of rats or mice, they should be efficiently incased in some hard material.

14. Where indoor wires are put out of sight, as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated.

N.B.—The value of frequently testing the apparatus and circuits cannot be too strongly urged. The escape of electricity cannot be detected by the sense of smell, as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III. LAMPS

15. Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting.

16. The lanterns, and all parts which are to be handled, should be insulated from the circuit.

IV. DANGER TO PERSON

17. Where bare wire out of doors rests on insulating supports, it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.

18. To secure persons from danger inside buildings, it is essential so to arrange and protect the conductors and fittings that no one can be exposed to the shocks of alternating currents of a mean electromotive force exceeding 100 volts, or to continuous currents of 200 volts.

19. If the difference of potential within any house exceeds 200 volts, the house should be provided with a "switch," so arranged that the supply of electricity can be at once cut off.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Dr. Humphry has formally resigned the Professorship of Anatomy, after having taught anatomy in the University for thirty-six years, at first as assistant to Prof. Clark, and since 1866 as Professor. The Electoral Board for the Professorship consists of Professors Huxley, Allen, Thompson, Flower, Paget, Newton, and Liveing, Dr. Michael Foster, and Mr. J. W. Clark.

The Honorary Degree of LL.D. will be conferred in June upon Count Menabrea, formerly Italian Ambassador to England, Prof. Pasteur, Prof. Michaelis (Strasburg), Sir A. Grant, Bart., Principal of Edinburgh University, Sir John Lubbock, Bart., Sir J. A. G. Ouseley, Bart., Professor of Music at Oxford, Sir Richard Temple, Bart., Lieut.-Gen. Walker, Surveyor-General of India, Mr. Matthew Arnold, Prof. W. W. Goodwin (Harvard, U.S.), Mr. Reginald S. Poole (British Museum), Prof. H. E. Roscoe (Owens College), and Mr. G. F. Watts, R.A.

The Graces creating a Professorship of Surgery without stipend, and authorising the immediate appointment of a Professor of Physiology, are to be voted on to-day (Thursday).

THE City and Guilds of London Institute has decided to make a grant of 300*l.* a year for five years, for the purpose of supporting a Chair of Mechanical Engineering in connection with Firth College, Sheffield.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 15.—"Atmospheric Absorption in the Infra-Red of the Solar Spectrum." By Capt. Abney, R.E., F.R.S., and Lieut.-Col. Festing, R.E.

Any investigations on the subject of atmospheric absorption are of such importance in the study of meteorology, that we have deemed it advisable to present a preliminary notice of certain results obtained by us, without waiting to present a more detailed account which will be communicated at a future date. From 1874, when one of us commenced photographing the spectrum in the above region, till more than a year ago, the extremely various manners in which the absorption took place caused considerable perplexity as to their origin, and it was only after we had completed our paper on the absorption of certain liquids [1] that a clue to the phenomena was apparently found. Since that time we have carefully watched the spectrum in relation to atmospheric moisture, and we think that more than a year's observations in London, when taken in connection with a month's work at an altitude of 8500 feet on the Riffel, justify the conclusions we now lay before the Society.

A study of the map of the infra-red region of the solar spectrum,[2] and more especially a new and much more complete one, which is being prepared for presentation to the Royal Society by one of us, shows that the spectrum in this part is traversed by absorption lines of various intensities. Besides these linear absorptions, photographs taken on days of different atmospheric condition show banded absorptions superposed over them. These latter are step by step absorptions increasing in intensity as they approach the limit of the spectrum at the least refrangible end. In the annexed diagram [3] Fig. 4 shows the general appearance of this region up to λ 10,000 on a fairly dry day: the banded absorption is small, taking place principally between λ 9420 and λ 9800: a trace of absorption is also visible between λ 8330 and λ 9420. On a cold day, with a north-easterly wind blowing, and also at a high altitude on a dry day, these absorptions nearly if not quite disappear. If we examine photographs taken when the air is nearly saturated with moisture (in some form or another) we have a spectrum like Fig. 1. Except with very prolonged exposure no trace of a spectrum below λ 8330 can be photographed. Fig. 2 shows the absorption-bands, where there is a difference of about 3° between the wet and dry bulbs, the latter standing at about 50°. It will be noticed that the spectrum extends to the limit of about λ 9420, when total absorption steps in and blocks out the rest of the spectrum. Fig. 3 shows the spectrum where the difference between the wet and the dry bulbs is about 6°. Figs. 5 and 6 show the absorption of thicknesses of 1 foot and 3 inches of water respectively, where the source of light gives a continuous spectrum. With $\frac{1}{8}$-inch of water all absorption-bands except that commencing at λ 9420 are absent. It will be seen that there is an accurate coincidence between these "water-bands" and the absorption-bands seen in the solar spectrum, and hence we cannot but assume that there is a connection one with the other. In fact, on a dry day it is only necessary to place varying thicknesses of water before the slit of the spectroscope and to photograph the solar spectrum through them, in order to reproduce the phenomena observed on days in which there is more or less moisture present in the atmosphere. It is quite easy to deduce the moisture present in atmosphere at certain temperatures by a study of the photographs. There does appear a difference, however, in the intensity of the banded absorptions in hot weather and in cold about up to 50°. In the former they are less marked when the degree of saturation and the length of atmosphere traversed are the same as in the latter.

The accepted view, we believe, of absorption of vapours is that they give linear absorptions in certain thicknesses, and as the thickness increases or the density becomes greater, the lines

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[1] "The Influence of the Atomic Groupings of the Molecules of Organic Bodies on their Absorption in the Infra-Red Region of the Spectrum." *Phil. Trans.*, Part III., 1881.

[2] *Phil. Trans.*, 1880.

[3] The black lines given in the diagram are merely lines of reference, and do not represent the aqueous absorption under consideration.

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